Saskatchewan Research Council
Annual Report 1986 - 1987

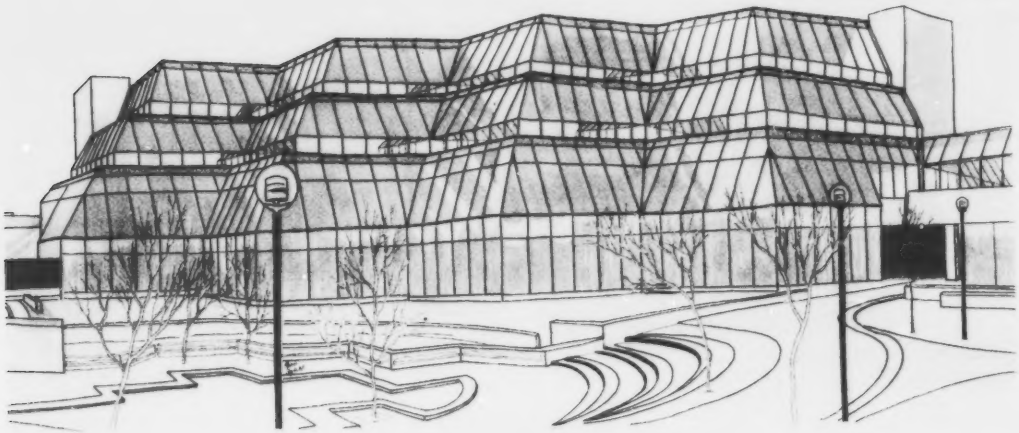
SRC
Saskatchewan
Research Council

88-03459/

Front cover photo:

The SRC Petroleum Division works with industry to develop Saskatchewan petroleum resources, with special emphasis on heavy oil. Current projects include improving techniques for enhanced oil recovery, production, treating, upgrading and refining. In the division's steam lab, researchers use a scaled physical model of the steam injection process. The condensers shown, similar to others in a number of SRC labs, are used to collect oil, water, and vapours during our steam flood experiments.

Celebrating 40 Years of Service
1947 - 1987



Saskatchewan Research Council Annual Report 1986-87

Saskatchewan Research Council is the provincial research organization dedicated to applying science and technology for Saskatchewan's development. As a result, SRC has developed skills uniquely suited to Saskatchewan's industrial, manufacturing, and resource sector needs.

A team approach for research and development and technology transfer is used by working with government departments, universities and the private sector.

SRC is organized around 17 areas of expertise. These are:

- geology and mining
- agriculture
- solids pipelining
- blood typing
- electronics
- aquaculture
- archaeology
- heavy oil
- CAD/CAM
- analytical chemistry
- manufacturing and product development
- cartography
- fuel and energy conservation
- air, land and water quality
- plastic fabrication
- remote sensing
- industrial engineering and marketing

We work to apply these areas of expertise to the research questions and problems that challenge our client groups, including:

- manufacturers
- engineering companies
- geologists
- farmers
- mining companies
- government departments
- resource managers

Hon. Ray Meiklejohn

Letter of Transmittal

February 10, 1988

TO THE HONOURABLE F.W. JOHNSON
Lieutenant Governor of the Province
of Saskatchewan

MAY IT PLEASE YOUR HONOUR:

The undersigned presents herewith, for your consideration, the report of the Saskatchewan Research Council for the year ended March 31, 1987.

Respectfully submitted,

Ray Meiklejohn

Ray Meiklejohn
Minister responsible for
Saskatchewan Research Council

The Research Council Act

Section 21, in part, directs that:

The Council shall on or before the last day of February in each year submit to the Lieutenant Governor in Council a report of its proceedings and transactions during the next preceding calendar year, which report shall contain such particulars as the Lieutenant Governor in Council may prescribe. Every report shall be laid before the Legislative Assembly if then in session, or if it is not in session, within fifteen days after the opening of the next session.

Board Of Directors Saskatchewan Research Council, 1987

Gordon C. Birney
Chairman, SRC
Partner, Birney & Smith
Chartered Accountants
Saskatoon

Jim Hutch
Secretary, SRC
President, SRC
Saskatoon

Honourable Ray Meiklejohn
Minister, Saskatchewan
Science and Technology
Regina

John Nightingale
Vice Chairman, SRC
President and Chief
Executive Officer
Key Lake Mining
Saskatoon

Leon Katz
Saskatoon

Hugo S. Maliepaard
Regina

W.L. (Bill) Whelan
Manager, Saskatchewan
Division, Canadian
Petroleum Association
Regina

Peter Nikiforuk
Dean, College of Engineering
University of Saskatchewan
Saskatoon

Cam Blachford
Dean of Graduate Studies
and Research
University of Regina
Regina

Marcel de la Gorgendiere
Partner, de la Gorgendiere,
Pederson, Pinch and Turnbull
Saskatoon

Oscar Hanson
Vice President
Corporate Affairs
Saskatchewan Power
Corporation, Regina

Carol Teichrob
Moonvale Farms
Saskatoon

Sharon Stevenson
Saskatoon

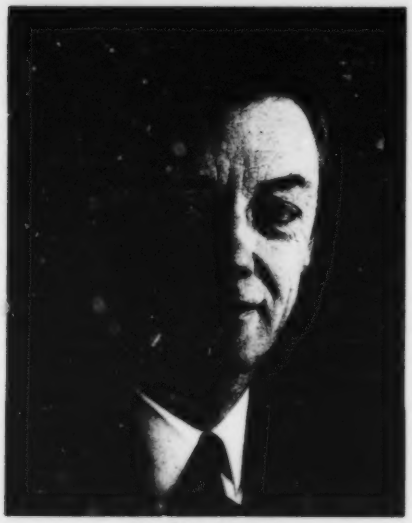
Patricia Weir
Walwyn, Stodgell, Cochran
Murray Limited
Investment Securities
Prince Albert

John Cross
Philom Bios Inc.
Saskatoon

Ross McQuarrie
Manager - Production
Northern Telecom
Canada Ltd.
Saskatoon

John G. Manns
Associate Vice President
(Research) and Dean
of College of Graduate
Studies and Research
University of Saskatchewan
Saskatoon

Gavin D. Semple
President & General Manager
Brandt Industries Ltd.
Regina



Gordon Birney

Chairman's Report

With a troubled economy, growth is difficult. But, over the past four years, growth at the Saskatchewan Research Council has been realized. Revenue has increased to $14 million from $10 million. Personnel has increased to 235 from about 180 four years ago. SRC is growing and is successful.

The effect of the October 19, 1987 stock market crash on the economies of Canada and the United States, and globally, has not yet been fully determined. Stock markets in Canada and throughout the world continue to be very volatile. Prices for our mineral resources continue to fluctuate. And, oil prices are extremely sensitive. Some countries' currencies have been severely weakened. Loans to some countries have become very doubtful of collection. Under these conditions, it is difficult to establish and maintain growth patterns for companies and organizations.

The maintenance of growth challenges every leader today. It is a time when research initiatives, innovative thinking and new and futuristic approaches to problems take a higher priority in corporate policy making.

SRC has people and facilities in place to respond to these needs. The diversity of the Saskatchewan economy provides many opportunities for research

Jim Hutch

President's Message

How do we survey the year in review and give our clients a sense of what we've accomplished? By taking a snapshot of a single day at SRC. Our scientists and engineers are found on any working day in a farmer's yard, in a factory, in the city or the country, in a university's laboratory with other scientists and engineers, in another country working with a manufacturing client as they transfer technology to another part of the world, in helping an oil company in the field improve their recovery from a well, or in some other part of Canada working with a Saskatchewan client. These experts from SRC have developed their expertise for the specific needs of our people and the development of the province. And this year SRC celebrated 40 years of successfully working to help foster that development.

In this day of rapid change we can never forget that people are the most important element in our success. The ultimate delivery of service is backed by support groups, by networks with companies, organizations, provincial and federal government people, international contacts, and a strong Board of Directors and many advisory groups: people interacting to provide benefits to Saskatchewan. It's this, SRC's relationship with the people we serve, that has been a constant throughout our 40-year history.

The applied nature of SRC's work makes it an exciting and challenging place to be. This year a research specialist in our Petroleum Division developed a proprietary chemical known as SRC-K1, which is used to overcome heavy oil pumping problems caused by emulsion formation. SRC-K1 is

applications. Agriculture, small implement manufacturing, heavy oil, potash, uranium, gold and a research community are but some of the diversified industries existing in Saskatchewan. And SRC has clients in all of these industries.

In response to clients' needs, SRC continued this year to provide services to Saskatchewan's gold, uranium and potash industries. New techniques were developed by our Geochemical Laboratory for heavy mineral processing for gold grain counting. A process for the accurate analysis of platinum and palladium was also developed in response to interest in platinum-group metals.

In the Petroleum Division, a mobile testing unit was put into operation, taking SRC services to the wellhead.

In Remote Sensing, this innovative program moved from that of training users in the province, to the establishment of a centre that now offers remote sensing products and services to resource managers across the country.

Our new Bovine Blood Typing Laboratory provides cattle producers across Canada with a comprehensive testing service for maintaining breed purity.

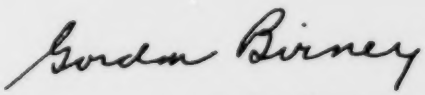
The Pipeline Development Centre is a world class facility that enhances the ability of this province to develop its heavy oil deposits.

These are a few of the ways in which SRC is meeting the needs of its clients. There are many more.

SRC will continue to meet the needs of its clients. By doing so, it will continue to identify new opportunities and challenges which will provide the basis for its continued growth. That growth will be achieved through the knowledge and dedication of the people of SRC.

SRC looks positively to the future in continuing to fulfill its mandate to apply science and technology for Saskatchewan's development.

I wish to extend my expression of thanks to my fellow board members for their support and commitment to the future development of SRC, to Jim Hutch in providing a strong leadership role, and to the people of SRC for their dedication to the continued growth of the organization.



Gordon Birney, C.A.
Chairman of the Board of Directors

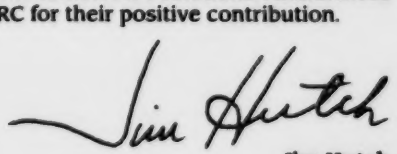
being used in the oil field. Over 40 farms in western Canada were involved in our research projects this year - Farm Enerdemo - where researchers are working with farmers to help lower their energy costs. An applied toxicology facility was opened in our Environment Division. And, one of our scientists, Dr. Stan Shewchuk, worked in China as part of an information transfer group organized by the Canadian International Development Agency (CIDA) on the subject of environmental pollution and the power industry. These are a few examples of the diverse and exciting work taking place at SRC on any given day.

We continue to make progress in working with other R&D organizations, whether they be universities, private companies, government labs, or other provincial research organizations. The idea is to bring to our Saskatchewan clients the benefits of the expertise and equipment available in Saskatchewan as well as outside of Saskatchewan. Similarly, R&D organizations within Saskatchewan and outside the province are making use of expertise and equipment within SRC. I like to think of this as introducing "national efficiency" to R&D organizations in Canada - in our case, for the benefit of the people in Saskatchewan. We can introduce efficiencies into our research and development and do more with less, by making sure that we are all aware of what each is doing, and by sharing our expertise and equipment.

Revenues for 1986/87 were $14.3M versus revenues for 1985/86 at $15.1M approximately. A word of explanation - removing employment assistance "flow-through" money from the picture indicates a real revenue for SRC for 1986/87 of approximately $14M and for 1985/86 for approximately $13.8M - hence we did show an increase of approximately $0.2M over the previous year. We recorded our first deficit ($138,420) in four years. In the past four years our revenue has grown from approximately $10M to $14M and our personnel have increased from 180 to 235.

SRC, a committed 40-year-old member of a network that has worked to find solutions to the complexities of Saskatchewan's growth, enters its 41st year well-equipped to find solutions for tomorrow. We move into the next year in a position of strength. And strength is needed to face the challenge and opportunities confronting industries such as agriculture, where lower input costs are needed, where crops must be diversified, and energy costs must be lowered. SRC's researchers are applying themselves to these very issues. In the manufacturing sector, the challenge and opportunities afforded by free trade will stimulate us all, while the tremendous potential offered by our petroleum industry continues to challenge the leaders of this industry.

And on any given day SRC's scientists and engineers will be found working to turn today's challenges into tomorrow's solutions. I thank these people of SRC for their positive contribution.



Jim Hutch
President

From a project aimed at gaining a better understanding of the geological processes responsible for gold deposition, to an investigation of kochia as a new high yielding forage crop, SRC's R&D Branch pursues an ongoing committment to transfer the technology developed and tested in our laboratories.

Under the direction of Dr. W.H.W. (Bill) Husband the Research and Development Branch encompasses the Resources Division, directed by Dr. Ralph Arnold, the Environment Division, directed by Dr. John Maybank, and the Petroleum Division, directed by Jim Hutchinson.

Resources Division

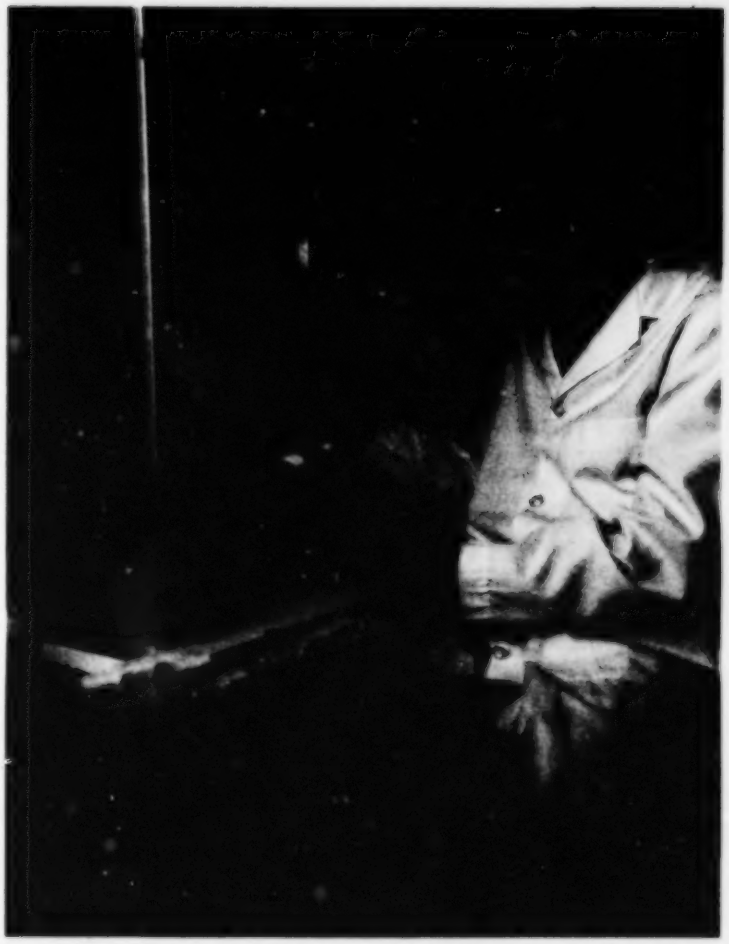
Saskatchewan's natural resources must be used efficiently to gain optimum benefits for the province. Our Resources Division provides applied research, development, and demonstration projects for Saskatchewan's industrial, agricultural, and resource-based economy. The following programs are organized to meet the R&D needs of our clients in the resources industries: Biomass Resources; Mineral Resources; Sedimentary Resources; and Buildings and Energy Technology.

Environment Division

The quality of Saskatchewan's water, land, and air resources is addressed by environmental scientists. These scientists provide research to clients on the maintenance, management, and improvement of the province's environmental resources. Emphasis is placed on assessing the environmental impact of industrial activity, transportation, and other major developments. Programs organized in the Environment Division include: Aquatic Biology; Terrestrial Ecology; Archaeology; Surface Hydrology and Remote Sensing; and Atmospheric Processes.

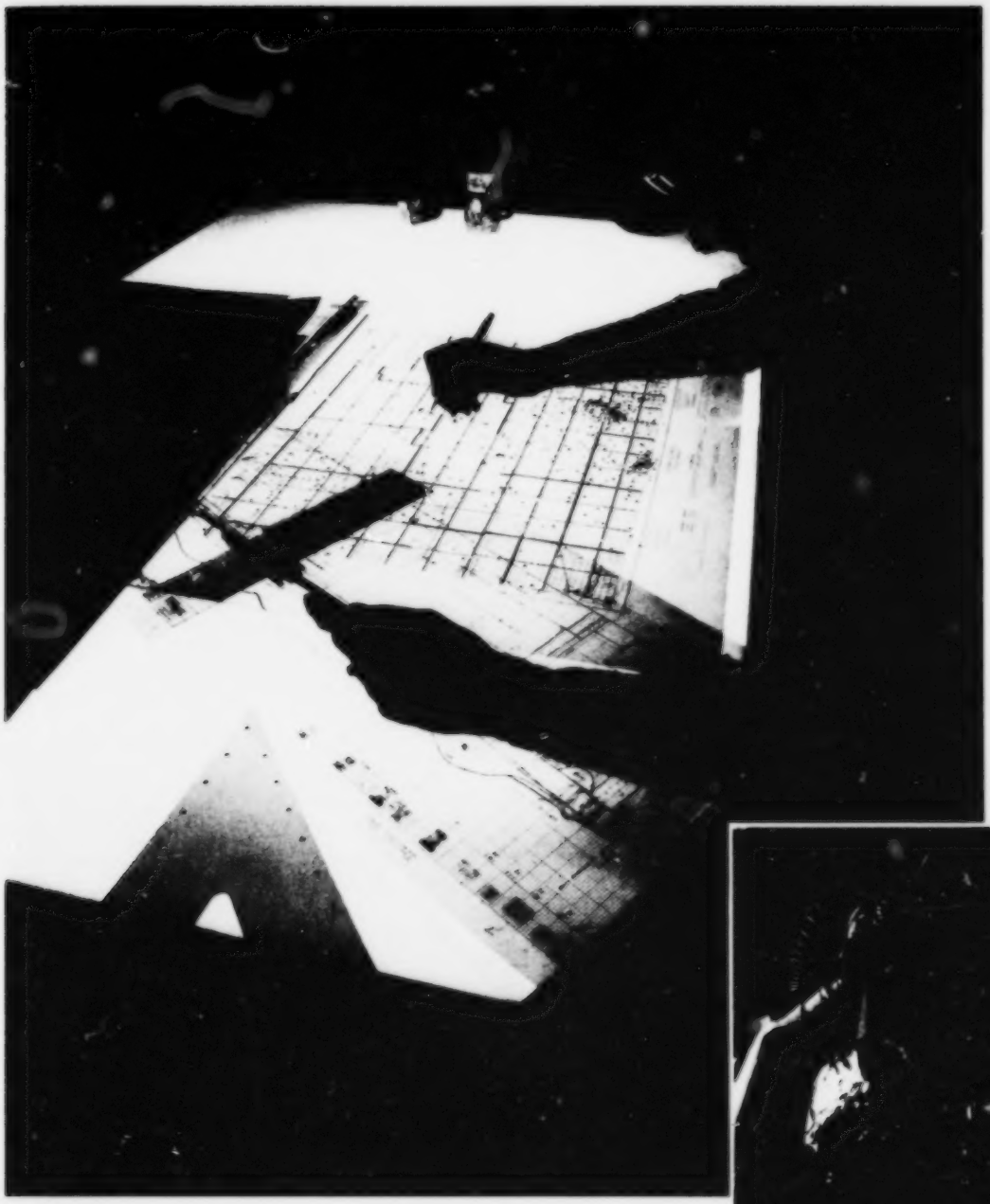
Petroleum Division

Laboratory research work taking place at our Regina-based Petroleum Division is addressing the recovery, production and upgrading challenges associated with Saskatchewan's heavy oil resource. Division laboratories combine research and field pilot testing to put new technology in place. The Petroleum Research Unit, Analytical Services Unit, and Technical Information Service address client needs.



Hans Peterson, Research Scientist in the Aquatic Biology program, studies algae control and pesticide toxicity to improve water quality in farm ponds and dugouts.

Research and Development Branch



Above:
Sedimentary Resources program staff study the geology, groundwater, and aggregate resources of Saskatchewan. In the water resources field, Mac Millard, Senior Research Technologist, interprets aquifer information to produce geology and groundwater maps.

Right:
At SRC's Petroleum Division laboratory, a wide range of fluids are processed in this short path distillation apparatus. Staff use it to separate materials with wide boiling ranges into two narrow range fractions.

Research and Development Branch Advisory Boards

REMOTE SENSING STEERING COMMITTEE

Leo Sayn Wittgenstein
Canada Centre for Remote Sensing
Ottawa, Ontario

John G. Manns
Associate Vice President (Research)
and Dean of College of Graduate Studies
University of Saskatchewan
Saskatoon, Saskatchewan

John Turnbull
Central Survey and Mapping
Saskatchewan Supply and Services
Regina, Saskatchewan

Vern Fowke
Saskatchewan Water Corporation
Moose Jaw, Saskatchewan

Jack Zepp
Economics Branch
Saskatchewan Agriculture
Regina, Saskatchewan

Doug Mazur
Saskatchewan Parks,
Recreation and Culture
Regina, Saskatchewan

Hugo Maliepaard
Regina, Saskatchewan

Royal Hinther
Provincial Coordinator
Science and Technology
Saskatoon, Saskatchewan

REMOTE SENSING USERS' COMMITTEE

Jack Mollard
J.D. Mollard and Associates
Regina, Saskatchewan

Bernie Kallenbach
Saskatchewan Water Corporation
Moose Jaw, Saskatchewan

Syd Barber
Saskatchewan Parks,
Recreation and Culture
Regina, Saskatchewan

Pat Beaulieu
Wildlife Branch
Saskatchewan Parks,
Recreation and Culture
Hudson Bay, Saskatchewan

Merve Ross
Research Division
Saskatchewan Crop Insurance
Regina, Saskatchewan

Keith Gorham
Fire Control
Saskatchewan Parks,
Recreation and Culture
Prince Albert, Saskatchewan

Larry Stanley
Forest Inventory
Saskatchewan Parks,
Recreation and Culture
Prince Albert, Saskatchewan

Alex Banga
Saskatchewan Water Corporation
Moose Jaw, Saskatchewan

Bill King
Saskatchewan Water Corporation
Outlook, Saskatchewan

Richard Dobbins
Statistics Canada
Tunney's Pasture
Ottawa, Ontario

Eeltje de Jong
Institute of Pedology
University of Saskatchewan
Saskatoon, Saskatchewan

John Polson
Research Scientist
Saskatchewan Research Council
Saskatoon, Saskatchewan

Jeff Whiting
Senior Research Scientist
Saskatchewan Research Council
Saskatoon, Saskatchewan

Helmut Epp
Canada Centre for
Remote Sensing
c/o Wildlife Habi... Section
Department of
Renewable Resources
Yellowknife, NWT

Above:
SRC's Archaeology team is actively involved in the study and preservation of Saskatchewan's historic and prehistoric heritage particularly in development areas. In the program's lab, Research Technologists Carol Beaulieu (left) and Peggy McKeand (right) clean and classify artifacts recovered from an archaeological site.

Right:
Buildings and Energy Technology staff operate a Product Testing Laboratory to provide manufacturers with product development support and testing services. Here, Jeff Flynn, Research Technologist, tests the compression and extension properties of building sealants.

PETROLEUM DIVISION
MANAGEMENT ADVISORY BOARD

Dale Christensen
Vice President, Production & Marketing
Saskoil
Regina, Saskatchewan

Bud Dahlstrom
Senior Vice President
Consumers' Co-op Refineries Ltd.
Regina, Saskatchewan

Bill Husband
Vice President, Research & Development
Saskatchewan Research Council
Saskatoon, Saskatchewan

Jim Hutch
President
Saskatchewan Research Council
Saskatoon, Saskatchewan

Bud McLean
Vice President, Production
Murphy Oil Ltd.
Calgary, Alberta

George Miller
President & Director of Research
Nova Husky Research Corp. Ltd.
Calgary, Alberta

John Reid
Assistant Deputy Minister
Saskatchewan Energy and Mines
Regina, Saskatchewan

Bob Skinner
Assistant Deputy Minister, Petroleum
Energy Mines & Resources
Ottawa, Ontario

Art Wood
Vice President
Engineering & Marketing
Norcen Energy Resources Ltd.
Calgary, Alberta

Grant Gunderson
Manager, Heavy Oil
Mobil Oil Canada Limited
Calgary, Alberta

PETROLEUM DIVISION
TECHNICAL ADVISORY COMMITTEE

Karl Miller
Coordinator, Thermal Area
Reservoir Engineering
Husky Oil Limited
Calgary, Alberta

Bill Thornton
Manager, Enhanced Oil Recovery
Murphy Oil Company Ltd.
Calgary, Alberta

Bill Husband
Vice President
Research & Development
Saskatchewan Research Council
Saskatoon, Saskatchewan

Jamie Kyle
Manager, Oil Development Division
Shell Canada Resources Ltd.
Calgary, Alberta

D.W. Mudie
Senior Petroleum Engineer
Engineering Department
Norcen Energy Resources Ltd.
Calgary, Alberta

G.A. Yeryk
Manager
EOR Projects, Saskoil
Regina, Saskatchewan

Les Court
Project Manager
NewGrade Energy Inc.
Regina, Saskatchewan

Dan McFadyen
Director, Energy Technology Branch
Saskatchewan Energy & Mines
Regina, Saskatchewan

Jim El Defrawy
Director
New Petroleum Supplies
Energy, Mines & Resources
Ottawa, Ontario

Jim Hutchinson
Director
Petroleum Division
Saskatchewan Research Council
Regina, Saskatchewan

Robert King
Research Associate
Texaco Canada Ltd.
Calgary, Alberta

The delivery of practical tools and "know-how" best describes the Technology Transfer Branch, where our engineers and technologists develop, test, and refine technologies and concepts for clients.

Led by Branch Vice President Ed Wiens, the following programs are organized under Technology Transfer: Product and Process Development, where the CAD/CAM Robotics Centre is located; Field Services, where the administration of the National Research Council's Industrial Research Assistance Program (IRAP) takes place; Precision Instrument, a group involved with the design and manufacture of plastics moulding systems and instrumentation products; Electronics, where measurement and control problems are solved; Innovation, a division devoted to serving all phases of product development, and the Canadian Centre for Advanced Instrumentation (CCAI), a resource centre solving client problems through the use of innovative instrumentation.

SRC's Product and Process Development Division works with the provincial manufacturing sector to introduce technologies such as Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) to product development. Here, Richard Reich, Research Specialist, uses a large-scale plotter to produce a design drawing.

Technology Transfer Branch Advisory Boards

CAD/CAM ROBOTICS CENTRE ADVISORY BOARD

Bill Reid
Regional Executive Director
Department of Regional Industrial Expansion
Saskatoon, Saskatchewan

George Lerchs
Director of Program Operations
Department of Regional Industrial Expansion
Saskatchewan Region

Ray Bentley
Manager of Industrial Programs
Department of Regional Industrial Expansion
Saskatchewan Region

Glenn Hantke
Product Development Supervisor
Morris Rod-Weeder Co. Ltd.
Yorkton, Saskatchewan

Bruce Cooke
Dean of Engineering
University of Regina
Regina, Saskatchewan

Dennis Johnson
President
Pakwa Engineering Ltd.
Saskatoon, Saskatchewan

CCAI ADVISORY BOARD

Ralph Cheesman
Saskatchewan Mining Association
Regina, Saskatchewan

Bill Reid
Department of Regional Industrial Expansion
Saskatoon, Saskatchewan

Bill Whelan
Canadian Petroleum Association
Regina, Saskatchewan

Howard Tennant
University of Saskatchewan
Saskatoon, Saskatchewan

John Cross
Philom Bios Inc.
Saskatoon, Saskatchewan

Bill Misskey
Engineering Division
University of Regina
Regina, Saskatchewan

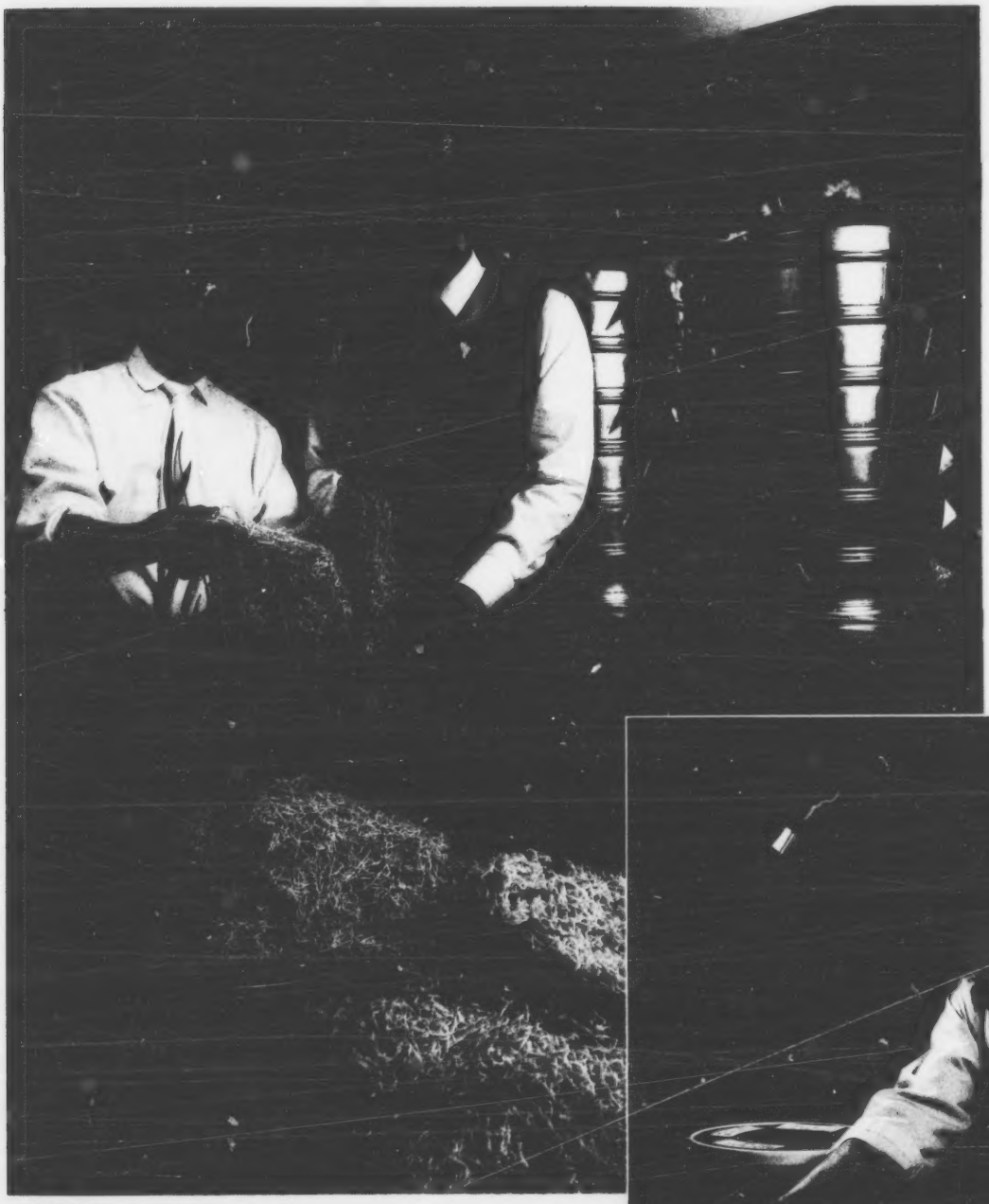
Larry Hanna
Saskatoon Chemicals
Saskatoon, Saskatchewan

Bob Lawrence
Saskatchewan Power Corporation
Regina, Saskatchewan

Don Barnett
Saskatchewan Research Council
Saskatoon, Saskatchewan

Jim Hutch
Saskatchewan Research Council
Saskatoon, Saskatchewan

Technology Transfer Branch



Above:
Field Services Division delivers the National Research Council's Industrial Research Assistance Program (IRAP) to Saskatchewan's small and medium-sized business sector. Roger Wong (right), a program Technical Advisor, meets Kent Mark (left), President of Mark Wings Noodle Manufacturing. The company received IRAP assistance to develop the custom steamer/deep-fryer (rear) used to produce several noodle products.

Right:
Technology Transfer Branch is home to the SRC CAD/CAM Robotics Centre where staff use this Cyber 930 computer system to develop computer-integrated manufacturing applications. The hardware also supports a computer-aided mapping project and digital analysis of remote sensing images. Here, Pat Dumontier, Research Technologist, loads a data tape into the Cyber's central processing unit.

The Administration and Finance Branch, led by George MacKay, Vice President, is responsible for the administrative systems in place at SRC. Human Resources; Departmental Services; the Information Centre; Graphics Services; Shops and Facilities Services; and Safety are collected under this branch. Also here is SRC's Analytical Services, a laboratory at the forefront of analytical technology, and the Bovine Blood Typing Laboratory, an addition to SRC this year.

The Information Centre provides library services and research information to all SRC projects. Kanchan Sthankiya, Library Clerk, checks a microform record of a government publications catalogue.

Administration and Finance Branch Advisory Board

BOVA-CAN ADVISORY BOARD

Ken Aylesworth
General Manager
Canadian Charolais Association
Calgary, Alberta

Henry Begrand
2nd Vice President
Canadian Charolais Association
St. Louis, Saskatchewan

Glenn Cherry
Secretary-Treasurer
Holstein Association of Canada
Brantford, Ontario

Dave Christensen
Head, Department of Animal and Poultry Science
University of Saskatchewan
Saskatoon, Saskatchewan

David Clemons
Chief Executive Officer
Holstein Association of Canada
Brantford, Ontario

Mel Gosling
Member Canadian Limousin Association
Dalemead, Alberta

Enid Jansen
Office Manager
Canadian Gelbvieh Association
Calgary, Alberta

Brian Kitchen
General Manager
Canadian Simmental Association
Calgary, Alberta

William Small
President
Canadian Simmental Association
Craven, Saskatchewan

Harvey Tedford
Secretary Manager
Canadian Limousin Association
Calgary, Alberta

Administration and Finance Branch

Above:
SRC's Bovine Blood Typing Laboratory delivers a unique service to Canadian breeders and their associations by providing parentage identification test services. Laurie Gerla, Research Technologist, performs tests to determine genetic characteristics of bovine blood samples.

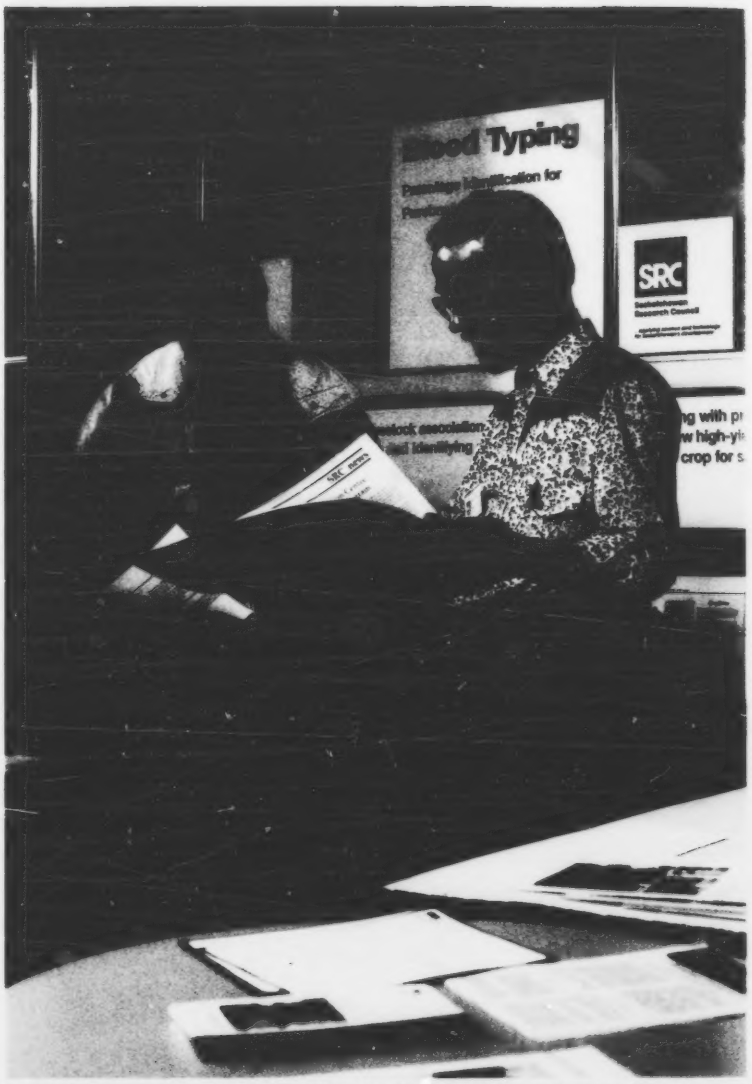
Right:
The Analytical Services Laboratory provides chemical, radiochemical, and materials analyses on a wide range of samples for a Canada-wide client group in resource, environmental, and quality control fields. Muzaffer Fahri, Research Scientist, monitors test results.

Business Development Branch

The main responsibility of the branch, headed by the Vice President of Business Development, Ravi Maithel, is to market the expertise, capabilities and facilities of SRC.

The Industrial Engineering and Marketing Division provides fee-for-services assistance in the areas of operations management and marketing studies, particularly as they relate to new product development.

The Communications Department is in this division. Publications such as the quarterly SRC News are published by the department, as well as the Annual Report, program brochures, and fact sheets. Tours and trade shows are managed by Communications.



Business Development is an excellent contact point to explore business opportunities with SRC. The branch helps market the expertise and capabilities of SRC's 20 research areas. Here, at Canadian Western Agribition, Bryce Erickson (right), Communications Officer, discusses SRC agricultural programs with Kim Hicks, Esso Ltd. Fertilizer and Chemical Manager.

GRANTS-IN-AID 1986-1987

SRC has provided grants to applicants in Saskatchewan universities for applied research in the sciences since 1947. This year six ongoing projects were allocated $55,000 and six new proposals received a further $55,000. Of the 12 supported projects four at the University of Regina received $27,500 and eight at the University of Saskatchewan $82,500.

The following projects were supported under the Grants-in-Aid program:

University of Saskatchewan - 1986-1987

Department of Chemical Engineering
N.N. Bakhshi
Pyrolytic Studies of Saskatchewan Heavy Oils with Additives

Department of Civil Engineering
M.D. Haug
Evaluation of Secondary Permeability in Sand-Bentonite Liners Used to Contain Uranium Wastes

Department of Crop Science and Plant Ecology
R.S. Bhatty
Cooking Quality of Saskatchewan-Grown Lentil

Department of Crop Science and Plant Ecology
R.E. Redmann
Comparative Injury to Saskatchewan Vegetation Caused by Acidic Precipitation

Department of Geological Sciences
W.G.E. Caldwell and T.K. Kyser
Geochemical Studies of Cretaceous Marine Cyclothemic Sequences in Saskatchewan

Department of Geological Sciences
M. Reeves
Triaxial Testing of Evaporite Rocks

Department of Management and Marketing
A.K. Sarkar and M. Ohtsu
Strengthening Technological Capabilities of Small Enterprises in Saskatchewan

Department of Mechanical Engineering
R.W. Besant and G.J. Schoenau
Monitoring, Testing, Modelling and Correlation of Basement Heat Losses and Air Infiltration and Ventilation in a Standard Bungalow House with Full Basement

University of Regina - 1986-1987

Department of Biology
D.R. Cullimore
A Microbiological Survey of Saskatchewan Groundwater Systems

Department of Engineering
J.C. Mozel
CAD/CAM Robotics Centre Maintenance

Department of Engineering
T. Viraraghavan
Coalescence/Filtration of Water in Oil Emulsions

Department of Geology
B.R. Watters
Geochemistry of Intrusive Rock Units of the Central La Ronge Domain

SCHOLARSHIPS 1986-1987

The Saskatchewan government offers graduate research scholarships, tenable at either the University of Saskatchewan or the University of Regina. The purposes of the awards are to assist graduate students to prepare for careers in scientific and industrial research, and to create interest in the development of Saskatchewan's resources and in techniques that will advance the diversification of the province's economy. SRC conducts the selection of the candidates.

Awards valued at $11,250 for the year beginning May 1, 1986 were made to:

H.J. Beckie
Department of Soil Science
University of Saskatchewan

K.M. Bell
Department of Geography
University of Regina

M.B. Thorpe
Department of Biology
University of Saskatchewan

Research and Development Highlights and Publications

The projects highlighted here illustrate the wide variety of work underway at SRC. Throughout most of these projects SRC scientists, engineers, and technicians are either under contract to, or working with, federal and provincial departments, crown corporations, agencies, universities, colleges, technical institutions, and private firms.

A Year In Review

Research and Development Branch

Dr. W.H.W. Husband, Vice President

Resources Division

Dr. Ralph Arnold, Director

Biomass Resources

Dr. Ewen Coxworth, Program Manager

R & D Highlights

- Studied methods to reduce fuel and fertilizer costs on farms (project known as Farm Enerdemo)
- Studied energy conservation benefits of pulse crops in rotation
- Study ongoing of the possible agronomic benefits of chaff collection
- Examining the conversion of vegetable oils into hydrocarbon cetane improvers for diesel fuel (joint study with the SRC Petroleum Division)
- Exploring methods to produce oyster mushrooms underground in potash mines
- Studied enzyme-assisted oilseed processing
- Investigating kochia, an annual wild plant of saline soils, as a new high yielding forage crop
- Research on allelopathy (natural herbicides in plants) continues.

Publications

The Effects of Reconstitution of Wheat Straw with Water Prior to Ammoniation on its Nutritive Value for Beef Cattle. (Abstract, Western Section, American Society of Animal Sciences, July 17-19, 1985 meeting, Moscow, Idaho)
Coxworth, E. Mandell, I.B. Nicholson, H.H. Christison, G.I.

Energy Use in Conservation Farming Practices. Presented at the Agricultural Institute of Canada (AIC) Annual Conference, Saskatoon, Saskatchewan, 1986
Coxworth, E. Wrubleski, E.M.

Kochia and Other Forages as Energy Crops. R-811-1-E-86
Kernan J. Sosulski, K. Green, D. Knipfel, J. Coxworth, E.

Farm Enerdemo Year 1 Report. R-812-2-B-86
Coxworth, E. Rutherford, A. Gimby, M.

Legumes in Zero-Till Cropping Systems. In Energy Evaluation of Cropping Practices, Vol. 3. R-812-1-E-86
Coxworth, E. Wright, T.

Feed Value of Hard Red Spring Wheat, HY320, and Winter Wheat Chaff, and Energy Costs of Collection and Feed Utilization. In Energy Evaluation of Cropping Practices, Vol. 2. R-812-1-E-86
Coxworth, E.

Nutritive Value of Norstar Winter Wheat Chaff as Affected by Ammoniation. Presented at the AIC Annual Conference, Saskatoon, Saskatchewan, 1986.
Coxworth, E. Knipfel, J.E. Juffinger, F.K.

Nutritive Value for Ruminants of Kochia at Mature Stages. Presented at the AIC Annual Conference, Saskatoon, Saskatchewan, 1986.
Coxworth, E. Kernan, J. Green, D.G. Knipfel, J.

Wet Milling vs. Air Classification of Field Peas to Isolate Protein, Starch and Fiber. Acta Alimentaria Polonica 11, 374. Symposium on Optimum Utilization of Raw Material in Food Production Under Limited Energy Supply. International IUFOST Symposium, Cracow, Poland.
Sosulski, K. Sosulski, F. McCurdy, A.

Delignification of Wheat Straw by Pleurotus spp. under Mushroom Growing Conditions. Applied Environmental Microbiology, 53:130 4-1306
Coxworth, E. Tsang, L.J. Reid, I.D.

Organizacja produkcji i ocena zboza oraz nasion oleistych w Kanadzie. Nowe Rolnictwo.
Sosulski, K. Sosulski, F.

Composition and Functionality of Protein, Starch, and Fiber from Wet and Dry Processing of Grain Legumes. In R.L. Orly (ed.) Evaluation of Plant Proteins: Applications, Biological Effects, Composition and Chemistry. Chp. 15, I[illegible]6. American Chemical Society, Washington, D.C.

Possibility of Use of Enzymes in Oil Extraction. 77th Annual Meeting of American Oil Chemists' Society, Honolulu, Hawaii, 1986.
Coxworth, E. Sosulski, K. Sosulski, F.

Solid State Fermentation to Produce Edible Mushrooms and Animal Fodder. 77th Annual Meeting of American Oil Chemists' Society, Honolulu, Hawaii, 1986.
Sosulski, K. Coxworth, E.

Composition and Nutritive Value of Northern Wild Rice, Zizania Palustris. 77th Annual Meeting of American Oil Chemists' Society, Honolulu, Hawaii, 1986.
Sosulski, K. Sosulski, F.

Carbohydrase Hydrolysis of Canola to Enhance Oil Extraction with Hexane. Journal of American Oil Chemists' Society.
Sosulski, K. Sosulski, F. Coxworth, E.

Alkaloids in Kochia. R-814-6-E-87
Sosulski, K.

Conversion of Vegetable Oils to Conventional Liquid Fuel Extenders. Proceedings of the Sixth Canadian Bioenergy R & D Seminar, Richmond, B.C., 1987.
Craig, W. Coxworth, E.

Chaff-Collection Costs and Processing Options. Proceedings of the Sixth Canadian Bioenergy R & D Seminar, Richmond, B.C., 1987.
Craig, W. Coxworth, E.

Possible Future Directions for Bioenergy in Agriculture. Proceedings of the Sixth Canadian Bioenergy R & D Seminar, Richmond, B.C., 1987.
Coxworth, E.

Evaluation of Kochia as a High Yielding Forage Crop for Saline Soils. R-814-1-D-86
Coxworth, E. Green, D. Knipfel, J. Kernan, J.

Evaluation of the Danish Ammoniation Oven.
R-814-2-E-86
Kernan, J.

Investigation of the Ammoniation of an Uncovered Pile of Cereal Chaff. R-814-1-E-87
Kernan, J.A.

Utilization of Canola Chaff for Feed. R-814-5-E-86
Kernan, J.A.

Mineral Resources

Michel Mellinger, Program Coordinator

R & D Highlights

- Produced a major summary of work on the genesis of the Athabasca uranium deposits
- Studying the characterization of the evolution of the Athabasca region
- Completed a mineralogical and chemical characterization of samples from a uranium property at Lake Athabasca
- Progressed with projects related to gold deposits in order to gain a better understanding of the geological processes of gold deposition
- Initiated a project on a new approach to the integrated interpretation of mineral exploration data using image analysis

Geochemical Laboratory

- Developed new analytical techniques in co-operation with clients requiring specialized analyses
- Analyzed approximately 30,000 samples averaging 10 elements per sample

Mineralogical Laboratory

- Analyzed approximately 2,500 samples for clay minerals
- Processed 200 samples for specific gravity determination and custom mineral identification work

Publications

Honey Bee Pollen Geochemistry: Data Evaluation and Analysis. R-851-1-E-86
Mellinger, M.

Correspondence Analysis: The Method and Its Application to Lithogeochemistry. R-851-2-D-86
Mellinger, M.

Uranium Deposits of the Athabasca Basin Field Trip Guide.
R-855-1-G-87
Sibbald, T.I. Quirt, D.H.

A Common Diagenetic-Hydrothermal Origin for Unconformity-type Uranium and Stratiform Copper Deposits.
R-855-5-A-86
Hoeve, J. Quirt, D.H.

Relationships Between Red-bed Diagenesis, Basin Evolution and the U-(Ni-Co-As) Mineralization in the Middle-proterozoic Athabasca Basin. R-855-6-A-86
Hoeve, J. Quirt, D.H.

Sedimentary Resources

Bryan Schreiner, Program Manager

R & D Highlights

- Computer mapping system was implemented (in cooperation with the CAD/CAM Robotics Centre)
- Investigations continued throughout the province on subjects including:
  - seasonal groundwater level change
  - Estevan buried valley aquifer and in the Regina area
  - hydrological effects of mining and other development
  - detecting pesticides in groundwater
  - groundwater heat pump demonstration
- Information on geology and groundwater conditions in several Rural Municipalities was prepared in cooperation with the Saskatchewan Institute of Pedology
- Continued to develop drift prospecting techniques for gold in the gold belt of Saskatchewan

Publications

Quaternary Geology of the Waddy Lake Area Applied to Prospecting for Gold. R-842-1-E-86
Campbell, J.

Quaternary Geology as a Guide to Mineral Exploration in the Southeastern Shield, Saskatchewan. R-842-6-B-86
Schreiner, B.T.

Drift Prospecting for Gold in Saskatchewan – Use of Heavy Mineral Concentrates in Tills. R-842-1-D-87
Sopuck V. Schreiner, B.T. Averill, S.

Drift Prospecting for Gold in the Southeastern Shield of Saskatchewan, Canada. R-842-2-D-87
Sopuck, V. Schreiner, B.T. Averill, S.

Quaternary Geology of the Sulphide – Hebden Lakes Area Applied to Prospecting for Gold. R-842-3-D-87
Campbell, J.

Quaternary Geology and Till Geochemistry of the Sulphide – Hebden Lakes Area. R-842-4-E-87
Campbell, J.

Quaternary Geology and Geotechnology – Field Trip 7 Guidebook R-842-5-A-87
Schreiner, B.T. Christiansen, E.A.

Towns of Indian Head and Maple Creek – History of Water Supply and Water Quality Data. R-844-6-E-86
Maathuis, H.

Fracture Permeability and Groundwater Flow in a Clayey Till near Saskatoon, Saskatchewan.
Keller, C.K. van der Kamp, G. Cherry, J.A.

Theory of Groundwater Flow in the Vicinity of Brine Ponds and Salt Tailings Piles. R-744-2-B-84
Maathuis, H. van der Kamp, G.

Nokomis Pesticide Investigation - Preliminary Documentation of Piezometer Installations. R-844-7-E-86
Maathuis, H.

Analysis of Drawdown and Recovery Data for Stepped-Rate Pumping Tests. R-844-2-A-87
van der Kamp, G.

20 Surficial Geology – South Maps (1:250,000)

20 Aggregate Resources Potential Maps (1:250,000)

Resources Processing
Walt Spyker, Program Manager
(Mr.Spyker passed away soon after his retirement in January, 1988.)

R & D Highlights

- Continued to work on the design and fabrication of rock mechanics instrumentation to measure stress and closure rates in potash mines
- Worked as a sub-contractor to Melis Consulting Engineers Ltd., during two major studies under the National Uranium Tailings Program
- Conducted studies on uranium ore leaching and mine water, and processed uranium ore samples
- Slurry Pipeline Development Centre researchers investigated the flow characteristics of mine tailings and studied the cause of product contamination in a multi-use pipeline

Buildings and Energy Technology
Dave Eyre, Program Manager

R & D Highlights

- Proceeded with a major Energy, Mines and Resources contract concerning caulks, sealants, and weatherstrip products
- Pursuing Canadian General Standards board approval for testing a number of products for their Qualified Products Listing
- Proceeded with a Compressed Natural Gas (CNG) study
- Developing new control systems for conversion of vehicles to CNG usage
- Designed farm CNG fuelling stations

Publications

Retrofit Weatherstrip: A Study of Products, Practices and Standards, Vol. 1. R-820-2-E-86
Eyre, D. Jennings, D.

Demonstrations of Compressed Natural Gas on Saskatchewan Farms. R-822-1-E-86
Sulatisky, M. Kaminski, T.

Progress Report 1: Scandia – Sheltair Study. R-823-1-E-86
Eyre, D.

Revised Work Plan, Stream A, Knowledge Base on Caulks and Sealants. R-823-3-E-86
Eyre, D.

The Effect of Exhaust Fans and Remedial Measures on House Depressurization. R-823-4-E-86
Eyre, D. Hanlin, T. Gray, B.

Development of Knowledge Base Relating to Indoor Use of Caulks, Sealants and Weatherstrip Products, Vol. 3: A survey of Toxic Volatiles in Caulks, Sealants and Weatherstrip Products. R-823-6-E-86
Jennings, D. Eyre, D.

Revised Work Plan – Stream B: Knowledge Base of Caulks and Sealants. R-823-7-E-86
Eyre, D.

DND Retrofit Study: Interim Report, 1986. R-825-4-E-86
Sulatisky, M. Flynn, J.

Environment Division
Dr. John Maybank, Director

Aquatic Biology
Dr. Stella Swanson, Program Manager

R & D Highlights

- Completed two studies on environmental impacts of gold mine effluents on receiving water. Information is being used by industry, Saskatchewan Environment and Environment Canada for reviewing allowable discharge rates
- Completed study of radionuclides in northern vegetation
- Study on the LIMCAL radionuclide food chain model completed
- Aquaculture research focussed on development of year-round egg production of rainbow trout brood stock and the rearing of arctic char in indoor recirculating tanks
- opened the Toxicology Laboratory
- monitored and evaluated water quality for private and public sector clients

Publications

Review of the City of Saskatoon, Sewage Treatment Plan. E-901-1-E-87
Swanson, S.M. Grismer, G.

Potential for Development of a Crayfish Industry in Saskatchewan. E-901-3-B-86
Sawchyn, W.

Bioconcentration Factor Parameter Distributions for and Analysis of the Aquatic Pathway Portion of the LIMCAL Foodchain Model. E-901-6-A-87
Swanson, S.M. Richert, D.

Radioactivity from Uranium Mining and Its Relationship to Fish. E-901-7-G-87
Swanson, S.M.

Identification and Evaluation of Impacts Resulting from the Discharge of Gold Mill Effluents. E-901-18-E-87
Melis, L.A. Tones, P.I. Swanson, S.M.

Terrestrial Ecology
Zoheir Abouguendia, Program Manager

R & D Highlights

- Continued with an evaluation of the potential effects of oil and gas drilling wastes on crops and soils
- Monitored soils and crops in the area of Coronach, Sask., to determine the environmental effects of the airborne emissions from the Poplar River Thermal Power Station.
- Studied the effects of acid rain on major Saskatchewan crops and forest trees
- Investigated the revegetation potential of the coal spoils of southern Saskatchewan
- Initiated a study to provide ecophysiological data to researchers involved with the development of the kochia plant as a forage crop
- Studied the factors required to improve the seeding success of forage plants
- used Landsat data in a regional assessment of terrestrial habitats

Publications

Effects of Leonardite on Soils and Forage Plants.
E-902-1-B-86
Godwin, R. Baschak, L. Abouguendia, Z.

Effects of Simulated Acidic Precipitation on Saskatchewan Crop and Forest Species. E-902-14-B-86
Baschak, L.A. Godwin, R.C. Abouguendia, Z.

Management of Canadian Grasslands for Conservation of Native Flora and Fauna. E-902-4-E-87
Abouguendia, Z.

Revegetation of Coal Spoils, Evaluation of Field Trials, 1985.
E-902-6-E-86
Godwin, R. Abouguendia, Z.

The Poplar River Agricultural/Environmental Monitoring Program, 1985. E-902-8-E-86
Shewchuk, S. Abouguendia, Z

Response of Two Western Canadian Conifers to Simulated Acidic Precipitation. E-902-19-A-85
Baschak, L. Abouguendia, Z.

Archaeology
Dr. David Meyer, Program Manager

R & D Highlights

- Nipawin Heritage Study entered the report writing stage, with Volume 8 completed and three more reports progressing
- Year's field work program complete in the Rafferty/Alameda reservoir area, as well as the Rafferty reservoir area and the associated Shand Thermal Power Plant, on the Souris River
- Work began on the archaeology of areas affected by proposed coal mine relocations in the Coronach region
- Feasibility study completed with regard to the archaeology of the Fort Carlton area

Publications

The Crown Site (FhNa-86) Excavation Results, Nipawin Reservoir Heritage Study, Vol. 8. Edited by D. Meyer
E-903-7-E-86
Quigg, J.M.

The Grant and McLeod, Neufeld Sawmill and Ives Cabin Sites, Nipawin Reservoir Heritage Study, Vol. 9. Edited by D. Meyer E-903-2-E-87
Klimko, O.

The Gorse Site, A Possible Sweat Lodge Feature Located Near Codette, Saskatchewan. E-903-1-A-87
Finnigan, J.

1986 Heritage Investigations at the Shand, Line A Rafferty Dam, and the Alameda Reservoir. E-903-6-E-87
Finnigan, J. Klimko, O.

The Selkirk Composite of Central Canada: A Reconsideration. Arctic Anthropology 1987: 1-31. E-903-12-E-86
Meyer, D.

Surface Hydrology
Jeff Whiting, Program Manager

R & D Highlights

- Completed the Saskatchewan Technology Enhancement Program (STEP) in co-operation with the Canada Centre for Remote Sensing, and other Saskatchewan departments
- Began planning for operation of the Saskatchewan Remote Sensing Centre
- Began a study measuring pesticides in surface runoff from irrigated plots
- Continued to build and service data retransmission equipment for hydro-meteorological and water quality clients
- Completed a study of western Canadian basin floods and low flows

Publications

Development Program for Saskatchewan's Remote Sensing Facility. E-905-6-E-86
Whiting, J.

Estimation of Flood Extremes (Probable Maximum Floods) for the Proposed Rafferty Dam, Saskatchewan. E-905-7-E-86
Whiting, J. Nicolichuk, N. Wheaton, E.E.

The Effects of Climate of Prairie Lakes. Presented to the Canadian Meterological and Oceanographic Society Symposium, Regina, June, 1986. E-905-1-A-86
Whiting, J.

Is the Largest North American Sub-Arctic Sand Dune Disappearing? Presented to the International Association of Hydrological Sciences, Vancouver, August, 1987.
E-905-10-D-86
Whiting, J. Wheaton, E.E.

Drought Monitoring With NOAA AVHRR and LANDSAT MSS Data in Southern Saskatchewan. Presented to Canadian Remote Sensing symposium, Waterloo, June, 1987.
E-905-11-D-86
Polson, J. Epp, D.

Integration of Digital Terrain Models into Ground Based Snow Measurement. Presented to the International Association of Hydrological Sciences, Vancouver, August, 1987.
E-905-1-A-87
Whiting, J. Kiss, J.

Special Enhancements Using Multispectral and Thematic Mapper Data in Pathlow and McCraney Pastures – A Preliminary Report. A Contract for Canada Agriculture.
E-905-5-E-87
Polson, J.

The Design of a Western Canadian Real-Time System for Integrated Forecasting of Basin Specific Flood and Low Flows. A Contract for Atmospheric Environmental Services.
E-905-6-B-87
Whiting, J. Wheaton, E.

Calculation and Accuracy of Humidity Value.
E-910-5-D-86
Fan, J. Whiting, J.

Attempt to Recast the Psychrometer Coefficient A of the Assmann Psychrometer by Comparison with the WMO Reference Psychrometer. E-910-6-D-86
Fan, J.

Atmospheric Processes

Dr. Stan Shewchuk, Program Manager

R & D Highlights

- Conducted research on precipitation extremes i.e., the probable maximum precipitation to be expected for the proposed Rafferty-Alameda dam watersheds
- Continued operating the Climate Reference Station, fulfilling numerous requests for climate data and preparation of the annual summary
- Continued to offer industry an air quality modeling service. In this regard, the climatology and air quality impact of a proposed potash mine in Manitoba was studied.
- Conducted research on the farm chemical droplet deposition and penetration efficiencies into crop canopy
- Maintenance of a watching brief on areas of concern to the provincial farming community i.e., the current drought cycle and wind erosion, and reported to the Expert Committee on Agrometeorology
- Determined the time and space characteristics of dust storms on the Prairies
- Continued to evaluate the automation of the Climate Reference Station
- Assessed the air quality and climatological impacts of selected industrial developments
- Studied the implications of climatic change for forestry and the forest industry of Western Canada (SRC leads a study team consisting of foresters and economists for phase I of this project)
- Conducted emissions testing service for industry
- Tested commercial sprayers for loss to the air
- Conducted acid deposition studies related to agricultural activities around the Saskatchewan Power Corporation Plant at Poplar River
- Continued work on indoor air pollution, such as asbestos in the work place
- Conducted a seminar on environmental impacts for the Thermal Power Industry at the Electric Power Research Institute, Xian, China

Publications

Rain, Snow and Lake Water Chemistry on and Near the Precambrian Shield of Western Canada. E-906-27-A-85
Shewchuk, S.R.

Fate of Diclofop-methyl After Application to a Wheat Field.
E-906-35-A-86
Shewchuk, S.R. Smith, A.E. Grover, R. Cessna, A.J.

Source and Ambient Sampling Relating to the Power Industry in North America. E-906-14-D-86
Wallace, K.W.

Saskatoon SRC Climatological Reference Station Annual Summary, 1986. E-906-2-B-87
Wheaton, E.E. Begrand, R.

A Comparison of Evapotranspiration Estimates from a Climatological Reference Station, 1986. E-906-7-B-86
Qing-Pei, Fei Shewchuk, S.R.

An Assessment of Kromekote Cards - Deposits from Aerial Spray Applications. E-906-1-B-87
Wallace, K.W. Jahren, R.

Rain chemistry of Saskatchewan. E-906-2-D-86
Shewchuk, S.R.

Pesticide Application Technologies. E-910-2-E-86
Maybank, J.

Calculation and Accuracy of Humidity Value.
E-910-5-D-86
Fan, J. Whiting, J.

Agrometeorological Activities in Saskatchewan, November, 1985 to October, 1986. Report to the Expert Committee on Agrometeorology Annual Meeting October, 1986, Quebec City, Quebec. E-906-45-D-86
Wheaton, E.E.

Atmospheric Environment Service Weather Services Policy and the Saskatchewan Research Council's Capability to Meet the Requirements. E-906-27-D-86
Shewchuk, S.R. Wheaton, E.E. Whiting, J. Begrand, R.

Automation of a Climate Reference Station: The Saskatchewan Research Council Climate Reference Station.
E-906-9-E-86
Wheaton, E.E. Shewchuk, S.R. Whiting, J.

Estimation of Precipitation Extremes in Southeastern Saskatchewan: Proposed Rafferty and Alameda Reservoir Watersheds. E-906-31-E-86
Wheaton, E.E. Whiting, J.

Tree Growth Responses to Changes in the Physical and Chemical Climate and Methods to Assess Economic Consequences. Presented at the International Union of Forest Research Organizations Workshop Vancouver, B.C., 1987.
E-906-17-D-87
Maybank, J. Wheaton, E.E. Van Kooten, G.C.

Some Characteristics of Dust Storms on the Prairies: The Case of Saskatchewan. Poster paper presented at the Aeolian Geomorphology Symposium, 1986, Guelph, Ontario.
Wheaton, E.E.

Agrometeorological Technical Session at the Agricultural Institute of Canada Conference, 1986. Climatological Bulletin 20 (3):51-53
Wheaton, E.E. Brown, D.M.

Some Temporal, Spatial and Climatological Aspects of Dust Storms in the Canadian Prairies. Abstract in Program and Abstracts of the 1987 American Association of Geographer's Annual Meeting in Portland, Oregon, 1987.
Wheaton, E.E. Chakravarti, A.K.

Some Temporal, Spatial and Climatological Aspects of Dust Storms in Saskatchewan. Climatological Bulletin, 21 (2).
Wheaton, E.E. Chakravarti, A.K.

Climatic Change/Variation Impact Assessment: Methodology and Case Studies. Paper presented at the joint meeting of the Prairie Division of the Candian Association of Geographers and the Great Plains/Rocky Mountain Division of the American Association of Geographers, Regina, Saskatchewan, 1987.
Wheaton, E.E.

Estimating Effects of Climate Change and Variability on Agriculture in Saskatchewan, Canada. Paper presented at the Symposium/Workshop on the "Impacts of Climatic Change and Variability on the Canadian Prairies," Edmonton, Alberta, 1987. Alberta Climate Advisory Committee, Alberta.
Williams, G.D. Fautley, R.A. Jones, K.H. Stewart, R.B.
Wheaton, E.E.

Estimating Effects of Climatic Change on Agriculture in Saskatchewan Canada. In M.L. Parry, T.R. Carter, and N.T. Konijn (eds.), 1987. The Impact of Climatic Variations on Agriculture, Vol. 1. Assessments in Cool Temperate and Cold Regions. Reidl, Dordrecht, The Netherlands.
Williams, G.D. Fautley, R.A. Jones, K.H. Stewart, R.B.
Wheaton, E.E.

An Exploration and Assessment of the Implications of Climatic Change for the Boreal Forest and Forestry Economics of the Prairie Provinces and Northwest Territories: Phase I. DSS contract No. 02SE.KM111-6-6330
Wheaton, E.E. Singh, T. Higginbotham, K.O. Dempster R. Thorpe, J.P. Van Kooten, G.C. Taylor, J.S.

Estimating the Effects of Climatic Change on Agriculture in Saskatchewan, Canada, Executive Summary. To be published.
Williams, F.D. Fautley, R.A. Jones, K.H. Stewart, R.B.
Wheaton, E.E.

Petroleum Division

Jim Hutchinson, Director

R & D Highlights

Enhanced Oil Recovery Research

Thermal Recovery

- Designed a scaled physical model to test steam injection. The model is being used to adapt the most widely used heavy oil recovery process (steam drive) to Saskatchewan's thin reservoirs
- Completed construction and testing of a combustion tube and this experimental capability is being used to shed light on technical problems for using the in-situ combustion process

Non-Thermal Recovery

- Studied the use of CO_2 to enhance the recovery of light oil by assessing the effects of contaminant gases during CO_2 injection and the effects of CO_2 slug size, CO_2 injection mode and in-situ solids precipitation
- Evaluated the economics of the use of CO_2 in heavy oil reservoirs and found that the estimated cost of recovery per cubic metre of oil is less sensitive to reservoir thickness than for thermal recovery methods.

Production and Upgrading Research

- Developed and marketed a proprietary chemical to overcome heavy oil pumping problems caused by emulsion formation
- Constructed a trailer-mounted emulsion treating unit for experimental work and troubleshooting at the wellhead
- Broadened the upgrading capabilities at the Division with the construction of two continuous flow reactor systems

Analytical and Technical Information Services

- Carried out $127,000 worth of analytical work for oil companies and supported Division research through chemical and physical analyses of oil, water and solids

Publications

Thermal Studies of Saskatchewan Heavy Oil Core Samples. Technical Report for the Period April 1, 1985-June 30, 1986. P-110-12-E-86
Verkoczy, B.

Miscible Displacement by Carbon Dioxide. A Literature Review: 1980-1985. P-110-13-E-86
Mourits, F.

Combustion Tube Studies for Saskatchewan Reservoirs. Technical Report for the Period April 1, 1985-June 30, 1986. P-110-14-E-86
Freitag, N. Exelby, R.

Development of a Steam Injection Program, Scaled Physical Model Studies. P-110-15-E-86
Kristoff, B.

Core Displacement Apparatus/Equipment and Procedures Evaluation. P-110-16-E-86
Knorr, K.

Report on the Comparison of the Adiabatic and High-Air-Flux Combustion Tube During Normal-Wet Combustion. Run 85-5 of October 29, 1985. P-110-18-E-86
Freitag, N. Exelby, R.

Enhanced Oil Recovery by Steam Injection. Final Report. P-110-17-E-86
Kristoff, B.J.

High Pressure Miscible Displacement of Saskatchewan's Light and Medium Oil Reservoirs. Technical Report for the Period April 1, 1985-June 30, 1986. P-110-19-E-86
Jha, K.N.

Laboratory Study of Heavy Oil Recovery with Carbon Dioxide. P-110-21-A-86
Jha, K.N.

Role of Thermal Analysis Techniques in the In-Situ Combustion Process. P-110-22-A-86
Jha, K.N. Verkoczy, B.

TGA/DSC Investigations of Saskatchewan Heavy Oils and Cores. P-110-25-A-86
Verkoczy, B. Jha, K.N.

Fluid Characterization of Saskatchewan Reservoirs. Technical Report for the Period April 1, 1985-September 30, 1986. P-110-26-E-86
Verkoczy, B. Jha, K.N.

Acid Numbers of Saskatchewan Heavy Oils.
Parker, R.J. Chung, E.S.
P-110-27-E-86

Data Base for the Heavy Oil Laboratory. Final Report.
P-110-28-E-86
Pappas, E.S.

Characterization and Treatment of Heavy Oil Emulsions. Interim Report for the Period November 30, 1985-October 31, 1986. P-110-29-E-86
Mourits, F.M.

Pyrolysis and Oxidation of Saskatchewan Heavy Oils. Interim Progress Report for Period November 30, 1985 - October 31, 1986. P-110-30-E-86
Lee, D.G. Mourits, F.M.

Sand Control. Testing the Hypothesis. P-110-32-E-86
Pappas, E.S.

Report on the Comparison of the High-Air-Flux and Adiabatic Tubes During Dry Combustion. P-110-37-E-86
Freitag, N. Exelby, R.

Equilibrium Phase Properties of the Hydrogen-Methane-Carbon Dioxide, Hydrogen-Carbon Dioxide-n-Pentane and Hydrogen-n-Pentane Systems. P-110-38-A-86
Freitag, N.P. Robinson, D.B.

Enhanced Heavy Oil Recovery By Carbon Dioxide Injection. Technical Report for the period April 1, 1985 - March 31, 1987. P-110-40-E-87
Huang, S. Jha, K.N.

Enhanced Heavy Oil Recovery by Carbon Dioxide Injection. Economic and Technical Feasibility of the CO_2 Immiscible Process. P-110-41-E-87

Characterization and Treatment of Saskatchewan Heavy Oil Emulsions. Technical Report for the period April 1, 1985 - March31, 1987. P-110-44-E-87
Mourits, F.M. Scoular, R.J. Kurucz, L.

Evaluation of Upgrading Characteristics of Saskatchewan EOR Feedstocks and Distillate Fractions. P-110-46-E-87
Soveran, D.W. Ogu, E.

Combustion Tube Laboratory Equipment. P-110-7-E-86
Exelby, R.

Feasibility/Scoping Study of a Novel Recovery Process for Saskatchewan Heavy Oil. Final report. P-110-8-E-86
Mourits, F.M.

Administration and Finance Branch

George MacKay, Vice President

Analytical Services

Dr. Gene Smithson, Program Manager

R & D Highlights

- Continued to provide analytical chemical services to industrial, government and private sector clients
- Maintained services in water analysis, environmental analysis, radio-chemical analysis, trace analysis, carbon-14 dating, and metal and alloys analysis for industry

Bovine Blood Typing Laboratory

Dr. Gerry Kraay, Program Manager

- Relocated from Ottawa to join SRC in Saskatoon
- Computerized the laboratory so that data on animals tested is immediately entered into the system
- Began offering electronic transmission of data to Breed Associations with electronic capabilities, reducing turn-around time
- Computerized lab procedures
- Initiated a research project on the use of DNA fingerprinting as a means of parentage testing
- 19,624 animals were blood typed, an increase of 11 percent over the year previous

Safety

Jerry Meginbir, Safety Officer

- Organized safety training courses for staff
- Investigated work-related accidents
- Initiated successful deletion efforts regarding incorrect occupational and non-occupational radiation exposures

Graphics Services

Bill Taylor, Program Manager
(Mr. Taylor retired February, 1988)

- Maintained a complete, multi-scale map/air photo library of Saskatchewan, providing SRC and its clients with topographic data
- Provided SRC and clients with services in cartography, drafting, photography, photomechanicals, computer graphics, desktop publishing, visuals, reports, publications, and display presentations

Publications

Services Available from Graphics Services. A-752-1-G-86
Taylor, B. Sardinha, C.

Departmental Services

Liz Weegar, Program Manager

- Produced 314 scientific/technical publications, an increase of 17.5 percent over the year previous

Information Centre

Margaret Samms, Program Manager

- Provided technical information support to all research programs within SRC through a complete library facility

Shops and Facilities Services

Ken Owens, Program Manager

- Maintained SRC facilities and equipment and provided services for specialized equipment needs

Technology Transfer Branch

Ed Wiens, Vice President

Product and Process Development Division

Gord Pierce, Director

- Technical advances were made to the data communications network permitting CAD/CAM specialists to train users in remote locations without actually being present. Assistance for this project was received from Canada Employment and Immigration Centre
- Handled a variety of product development/design engineering projects for 28 Saskatchewan manufacturers and entrepreneurs

Publications

Design Guide Derivation From Timber Vehicle Study for Saskatchewan Highways and Transportation. I-4304-1-E-87
Malinoski, A.

Reference Appendices For Design Guide Derivation From Timber Vehicle Study for Saskatchewan Highways and Transportation. I-4304-2-E-87
Malinoski, A.

Instruction Manual for Archiving and Reclaiming Files.
I-4310-1-E-86
Osborne, N.

Field Services Division

Don Glossop, Director

- Continued to administer the Industrial Research Assistance Program (IRAP) under contract with the National Research Council (NRC)
- A separate Annual report for the 1986/87 fiscal year, detailing program elements and selected case histories, is available on IRAP Saskatchewan from Field Services Division or Communications Department

Innovation Division

John Thauberger, Director

- Redesigned and provided marketing assistance, to a developer, on a consumer product for automobiles, Life Lites
- Completed a prototype and first sale of the Able-Lift, a chair lift for the handicapped
- Completed a prototype of the Linnco Pump Patrol
- Completed assistance on manufacturing an agricultural conveyer belt for a private company
- Provided business assessments on nine other product ideas

Canadian Centre for Advanced Instrumentation (CCAI)

Don Barnett, Director

- Conducted a feasibility study on a field water sampler
- Exhibited the MINITUBE™. Air Sampling System in Sweden and Greece and made a sale to the West German Army
- Developed, manufactured and distributed an oilseed crusher
- Provided technical evaluation of a device to automatically maintain a preset, constant blade angle on a road grader
- Signed a memorandum of understanding with the Alberta Electronics Test Centre to assist small and medium businesses in Saskatchewan
- Developed a plastics resource centre
- Continued to provide instrument repair and calibration services to clients

Business Development Branch

Ravi Maithel, Vice President

- Assisted seven SRC program areas with general strategy formulation, market studies, market strategies and problem solving
- Continued with the application of a Distribution Requirements Planning system for a large corporation
- Entered the second phase of a project studying the process of technology adoption by small and medium-sized enterprises in Malaysia
- Concluded the administration of Saskatchewan's Product Development Management Program (PDMP). Over 50 manufacturers received assistance ranging from engineering design to marketing strategy development

Communications

Katherine Lawrence, Program Manager

- Produced a variety of news releases, brochures, and publications in support of SRC activities (Annual Report, SRC News)
- Coordinated trade show displays for corporate and program level involvement
- Produced a video for the Slurry Pipeline Development Centre
- Handled tours, receptions, and media inquiries

The Saskatchewan Research Council
Year Ended March 31, 1987

Financial Statements

Auditor's Report

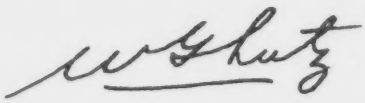
To the Members of the Legislative Assembly
of Saskatchewan

I have examined the balance sheet of The Saskatchewan Research Council as at March 31, 1987 and the statements of revenue, expenditure and accumulated surplus and changes in financial position for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Council as at March 31, 1987 and the results of its operations and the changes in its financial position for the year then ended in accordance with the accounting principles described in Note 2 to the financial statements applied on a basis consistent with that of the preceding year.

Regina, Saskatchewan,
October 23, 1987.

W.G. Lutz, F.C.A.,
Provincial Auditor.



Statement 1

BALANCE SHEET

As At March 31

ASSETS	1987	1986
Current assets:		
Accounts receivable	$3,002,821	$2,396,610
Prepaid expenses	36,847	38,418
Inventory	235,276	258,746
	3,774,944	2,693,774
Deferred charges (Note 6)	229,384	137,631
Fixed assets (Note 4)	2,936,367	2,704,599
Other assets	3,939	3,939
	$6,944,634	$5,539,943
LIABILITIES AND PROVINCE'S EQUITY		
Current liabilities:		
Bank indebtedness	$2,092,839	$ 88,677
Research grants payable	97,940	109,626
Accounts payable	979,936	973,404
Accountable advance (Note 7)	1,080,726	1,125,915
Employee deductions payable	247,076	308,982
Deferred revenue (Note 5)	400,185	761,700
Vacation and benefits payable	244,847	250,446
Retroactive salaries payable (Note 8)	159,742	-
	5,303,291	3,618,750
Non-current liabilities:		
Sick leave benefits payable	334,927	312,027
Deferred revenue (Note 5)	573,948	738,278
	6,212,166	4,669,055
Province's equity:		
Accumulated surplus (Statement 2)	732,468	870,888
	$6,944,634	$5,539,943

(See accompanying notes to the financial statements)

Statement 2

STATEMENT OF REVENUE, EXPENDITURE AND ACCUMULATED SURPLUS

Year Ended March 31

	1987	1986
Revenue:		
Contracts (Note 5)	$ 9,501,090	$ 8,997,530
Provincial government grant		
— general purpose	4,080,570	4,316,410
— employment assistance programs	465,049	1,414,951
Interest	36,434	96,490
Other (Note 5)	255,521	228,754
	14,338,664	15,054,135
Expenditure:		
Salaries	7,888,765	7,587,244
Employee benefits	915,810	864,097
Supplies and technical services	2,528,355	2,564,339
Employment assistance programs	312,913	1,166,951
Depreciation	814,306	715,556
Travel and vehicle operations	398,195	331,452
Rent and utilities	656,196	774,698
Printing and publishing	292,204	280,648
Communications	266,611	225,978
Research grants	97,940	110,000
Other	305,789	136,497
	14,477,084	14,757,460
(Deficit) excess of revenue over expenditure	(138,420)	296,675
Accumulated surplus, beginning of year	870,888	574,213
Accumulated surplus, end of year — (Statement 1)	$ 732,468	$ 870,888

(See accompanying notes to the financial statements)

Statement 3

STATEMENT OF CHANGES IN FINANCIAL POSITION

Year Ended March 31

	1987	1986
Cash provided by (used in):		
Operating Activities:		
(Deficit) excess of revenue over expenditure	$ (138,420)	$ 296,675
Add (deduct) items not affecting cash:		
Depreciation	814,306	715,556
Amortization of deferred revenue	(761,700)	(351,521)
(Gain) on disposal of fixed assets	(595)	(6,773)
(Increase) in deferred charges	(91,753)	(137,631)
Increase in sick leave benefits payable	22,900	18,730
	(155,262)	535,036
Net change in non-cash working capital balances related to operations (Note 9)	(803,422)	985,206
Net cash (used in) provided by Operating Activities	(958,684)	1,520,242
Investment Activities:		
Purchase of fixed assets	(1,048,415)	(1,303,740)
Proceeds from sale of fixed assets	2,937	7,000
Net cash (used in) Investment Activities	(1,045,478)	(1,296,740)
Increase (decrease) in cash position	(2,004,162)	223,502
Bank indebtedness, beginning of year	(88,677)	(312,179)
Bank indebtedness, end of year	$(2,092,839)	$ (88,677)

(See accompanying notes to the financial statements)

NOTES TO THE FINANCIAL STATEMENTS

1. Status of the Saskatchewan Research Council

The Saskatchewan Research Council was established pursuant to Section 3 of The Research Council Act for the purpose of research and investigation in the fields of the physical sciences, pure and applied, as they affect the economy of the Province of Saskatchewan. The Council is a body corporate which receives moneys appropriated by the Legislature for these purposes and is also empowered to conduct research under contract for others and to receive financial assistance pursuant to agreements with other similar agencies.

2. Summary of Accounting Policies

(a) Revenue Recognition

Grant revenue is recognized in the accounts as follows:

i) Moneys appropriated by the Legislature for the general purposes of The Research Council Act are recorded in the same period the moneys are paid from the Consolidated Fund.

ii) Other grants received for specific purposes are included in revenue to the extent of related expenses incurred during the year. Grant receipts in excess of related expenses are reflected as deferred revenue.

Revenue from the majority of contract work is recognized on the percentage-of-completion method which recognizes revenue as a contract progresses. Unbilled revenues are accrued to the year end for these contracts, while pre-billed revenues received are classified as deferred revenue.

Revenue from analytical lab work, involving shorter term contracts without substantial outlays of direct costs, is recognized on a completed contract basis.

(b) Inventory

Inventory consists of general supplies and goods held for resale. Inventories are valued at the lower of cost or net realizable value.

(c) Fixed Assets

The assets of the Council are initially recorded at cost, including labour, material and overhead for self-constructed assets.

Depreciation is provided over the estimated useful lives of the assets on the following basis:

(i) Sum-of-the-years'-digits method	
Buildings	20 years
Leasehold improvements	5 years
Equipment	10 years
(ii) Declining balance method	
Automotive	33⅓%

(d) Pension Costs

The Council participates with its employees in a defined benefit final average pension plan and, in accordance with recommendations of the Plan's actuary, contributions to the Pension Fund by the Council are made in amounts necessary to fund benefits accruing for current service and to fund past service benefits, if any, over reasonable time periods. The cost of funding the Pension Plan on the basis recommended by the actuary is reflected in these statements to the extent of contributions made to the Pension Fund in each year.

(e) Research Grants

Research grants awarded annually by the Council to aid in funding approved research projects are charged to expenditure in the year in which costs are incurred on the projects.

(f) Accrued Vacation Credits

The costs associated with vacation credits are recognized when the vacation entitlements are earned. The value of credits plus associated employee benefit costs earned to the year end but not taken are reflected as a liability.

(g) Sick Leave Benefits

The Council allows unused sick leave credits to accumulate over the term of employment for each employee and pays out 10% of the unused accumulated sick leave based on the wage rate in effect at the time of termination of employment. The costs associated with these sick leave benefits are recognized when benefits are earned and accumulated by employees at a rate of 10% of the unused accumulated value of credits earned.

3. Pension Plan — Actuarial Valuation

An actuarial valuation was performed as at January 1, 1987 on The Saskatchewan Research Council Employees' Pension Plan. The actuary stated that using the accrued benefit actuarial cost method, the present value of accumulated benefits resulting from services provided to the valuation date was $9,769,786. The actuary also stated that the value of Pension Fund assets as $10,731,651 based on averaged market values. The resulting net actuarial surplus is stated to be $961,865. The report recommends that the Council contribute at least 105% of employee contributions to meet the cost of benefits to be earned for service after the valuation date.

The next actuarial valuation is required to be performed no later than as at January 1, 1990.

4. Fixed Assets

	1987			1986
	Cost	Accumulated Depreciation	Net Book Value	Net Book Value
Buildings	$ 756,860	$ 456,647	$ 300,213	$ 344,931
Leasehold Improvements	515,478	463,396	52,082	11,960
Equipment	6,359,601	3,819,896	2,539,705	2,296,658
Automotive	244,909	231,542	13,367	20,050
Land	31,000	-	31,000	31,000
	$7,907,848	$4,971,481	$2,936,367	$2,704,599

5. Deferred Revenue

(a) Potash Corporation of Saskatchewan

The Council has deferred revenue of $235,099 from the Potash Corporation of Saskatchewan for prepaid rent of a pilot plant. The revenue is being reflected in the accounts by the sum-of-the-year's-digits method over the 10 year term of the agreement which commenced in the 1981-82 fiscal year. The current portion of this deferred revenue is $65,899 and is classified accordingly on the balance sheet while the amount included in other revenue in the current year is $70,543 (1986 — $75,286).

(b) Government of Canada

During the year, the Council received $375,000 (1986 — $725,000) from the federal government under an agreement to jointly fund the costs of operating the Computer-Aided Design and Computer-Aided Manufacturing (CAD/CAM) Centre. The portion of this amount attributable to capital costs of $33,412 (1986 — $301,818) is being amortized in the accounts by the sum-of-the-years'-digits method over a ten year period which corresponds to the depreciation period of the assets purchased under the terms of the agreement, which commenced in 1984-1985 fiscal year. The current portion of the deferred revenue is $125,769 and is classified accordingly on the balance sheet while the amount of revenue included in contract revenue in the current year is $142,767 (1986 — $153,101).

The remaining $341,588 (1986 — $423,182) of the amount received in the current year relating to this agreement, attributable to operating costs, is also included in contract revenue. Under the terms of the agreement, the Government of Canada will contribute an additional $470,000 over the next four years.

6. Deferred Charges

In accordance with the agreement between Advanced Technology Training Centre of Saskatchewan and the Council dated October 4, 1985, the Council has provided the Centre funding for certain CAD-CAM equipment purchases in return for specified computer services.

During the year, the Council paid $183,507 (1986 — $183,507) to the Centre of which $229,384 (1986 — $137,631) is classified as deferred charges and is amortized on a straight-line basis over the four year period in which the computer services are to be received.

7. Accountable Advance

This advance was made by the Department of Energy and Mines to minimize any cash flow problems resulting from the transfer of the Heavy Oil Lab to the Council. Under the memorandum of understanding between the Department and the Council dated August 27, 1985, the Council agrees to utilize this advance exclusively for the Petroleum Division's lab activities relating to contracts with the Department. Also, one-half of all interest earned as determined by the above Memorandum of Understanding shall accrue to the Department. The Council reduces the advance by offsetting it with current charges applicable to contracts with the Department once it receives written direction from the Department to do so.

8. Retroactive Salaries Payable

This amount represents the 1986 merit salary adjustment approved by the Board.

9. Statement of Changes in Financial Position

The net change in non-cash working capital balances related to operations is comprised of the following:

	1987	1986
(Increase) decrease in accounts receivable	$(1,106,211)	$ (433,537)
(Increase) decrease in prepaid expenses	1,571	(236,228)
Decrease in inventory	23,470	-
(Decrease) in research grants payable	(11,686)	(4,301)
Increase (decrease) in accounts payable	6,532	(528,915)
Increase (decrease) in accountable advance	(45,189)	1,125,915
Increase (decrease) in employee deductions payable	(61,906)	134,011
Increase in deferred revenue	235,854	843,402
Increase (decrease) in vacation and benefits	(5,599)	84,859
Increase in retroactive salaries	159,742	-
	$ (803,422)	**$ 985,206**

10. Related Party Transactions

Related parties to the Council are Saskatchewan's Crown controlled departments, agencies and corporations. Transactions with these parties are conducted at prevailing market prices except for certain buildings built for The Saskatchewan Research Council's use by the Department of Supply and Services at no cost to the Council and except for certain operations of the Petroleum Division as described below.

In June, 1985, the Council established a Petroleum Division by assuming the operations of the Heavy Oil Lab, previously operated by the Saskatchewan Oil and Gas Corporation, for a nominal amount of one dollar. The acquisition includes equipment and leasehold improvements with an original purchase price of $2.9 million. The Petroleum Division conducts a substantial portion of its research with the Department of Energy and Mines. These transactions of $2.7 million are conducted at rates established in contractual agreements between the Council and the Department of Energy and Mines.

11. Comparative Figures

The comparative financial statements have been reclassified from statements previously presented to conform to the presentation of the 1986/87 financial statements.

Staff of the Saskatchewan Research Council

(as of February, 1988)

President's Office

President:
Jim Hutch, B.Sc., P.Eng.

Secretarial Staff:
B. Gilroy

Research and Development Branch

Vice President:
W.H.W. Husband, M.B.A., Ph.D., P.Eng.

Resources Division

Director:
R.G. Arnold, Ph.D.

Mineral Resources Program

Coordinator:
M. Mellinger, Doc. Spc., M.A.Sc., P.Eng.

Staff:
J. Dyck, Ph.D., P.Eng.
D. Quirt, M.A.Sc.
J.W.J. Smith, B.Sc.
A. Holsten, B.Sc.
P. Archibald, B.A.
B. Bell
S. Cutts
B. Gartner
A. Jackson
C. McClelland
R. Brule
R. McKnight, B.A., C.E.T.

Biomass Resources Program

Manager:
E. Coxworth, Ph.D.

Staff:
W. Craig, Ph.D.
J. Kernan, M.Sc.
A. Rutherford, M.Sc.
K. Sosulski, Ph.D.
M. Gimby, Dip. Agr.
P. Kullman
E. Swerhone
A. Mair

Sedimentary Resources Program

Coordinator:
B.T. Schreiner, M.Sc., P.Eng.

Staff:
H. Maathuis, M.Sc.
G. van der Kamp, Ph.D.
M. Simpson, B.A.
J. Campbell, B.Sc.
E. Jaworski, R.R. Tech.
T. Warkentin, Chem. Tech.
D. Zlipko, Water Sci. Tech.
J. Stoutenburg, B.Sc.
M. Millard, B.Sc.

Buildings and Energy Technology Program

Manager:
D. Eyre, B.Sc., C.Phys., F.Inst.P

Staff:
M. Sulatisky, M.Sc., P.Eng.
D. Jennings
J. Flynn
S. Niyazi
B. Rooks, B.Sc., P.Eng.
R. Gillies, M.Sc., P.Eng.
J. Lehtinen, B.Sc.
D. Haas, M.Sc., P.Eng.
M. Small, Chem. Tech.
J. Lychak
J. Jones, I. Tech.
P. Schergevitch

Environment Division

Director:
J. Maybank, Ph.D.

Aquatic Biology Program

Manager:
S. Swanson, Ph.D.

Staff:
H. Peterson, Ph.D.
P. Tones, Ph.D.
K. Bindle
B. Paquin, R.R. Tech.
D. Richert, R.R. Tech.
C. Rickard, R.R. Tech.

Terrestrial Ecology Program

Manager:
Z. Abouguendia, M.Sc.

Staff:
J. Polson, M.Sc.
B. Godwin, B.S.A.
L. Baschak, B.S.A.

Archaeology Program

Manager:
D. Meyer, Ph.D.

Staff:
J. Finnigan, M.A.
O. Klimko, M.A.
C. Beaulieu, B.A.
B. Ferris, B.A.
P. McKeand, B.A.
D. Russell, B.A.

Surface Hydrology Program

Manager:
J. Whiting, M.Sc.

Staff:
R. Bouvier
R. MacPherson
N. Nicolichuk, Civ. Eng. Tech.
B.J. Smith

Atmospheric Processes Program

Manager:
S. Shewchuk, Ph.D.
Staff:
K. Wallace, B.Sc.
E. Wheaton, M.Sc.
R. Jahren, R.R. Tech.
R. Begrand, B.Sc.
J. Ross

Petroleum Division

Director:
J. Hutchinson, M.S., P.Eng.

Administration:

R. Hearn, Dip. Bus.
J. Giesinger
Senior Secretary:
E. Goodin

Petroleum Research Unit

Manager:
R. Ranganathan, Ph.D.
Staff:
N. Freitag, Ph.D., P.Eng.
S. Huang, Ph.D.
B. Kristoff, B.S. M.E., P.Eng.
F. Mourits, Ph.D.
E. Ogu, M.Sc.
E. Pappas, B.S. M.E., P.Eng.
J. Scoular, B.S. Ch.E., P.Eng.
D. Soveran, B.S. Ch.E., P.Eng.
B. Verkoczy, Ph.D.
P. deWit, Chem. Tech.
R. Exelby, Mech. Eng. Tech.
C. Jackson, B.Sc.
I. Kitamura
K. Knorr, Mech. Eng. Tech.
K. Kovacs, Chem. Eng. Tech.
L. Kurucz, Chem. Tech.
N. Shatilla, Chem. Tech.
D. Hymers

Analytical Services Unit

Staff:
E. Chung, B.Sc.
M. Cecchetto, Chem. Eng. Tech.
G. Perron, Bio. Sc. Tech.
N. Gaveronski
V. Barnabe

Technical Information Services

D. Sinclair
E. Exelby

Technology Transfer Branch

Vice President:
E.H. Wiens, M.B.A., M.Sc., P.Eng.

Product and Process Development Division

Director:
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Staff:
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A. Malinoski, B.Sc., P.Eng.
D. Florizone, Mech. Eng. Tech.
R. Reich, Arch. Tech.
A. Grimsen
K. Holdstock, Micro Computer Mgmt. Tech.
C. Jahren, B.A.
H. Wooff, CAD/CAM Eng. Tech.
P. Dumontier, B.Sc.
C. McKenzie, M.B.A., P.Eng.

Field Services Division

Director:
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B. Zuk, B.A., B.Sc., P.Eng.
G. Kocdag, B.Sc.
R. Wong, B.E., P.Eng.
F. Popoff
J. Sher, B.Sc., P.Eng.
L. Sopher, B.Ed.
W. Stange, B.Sc. P.Eng.

Innovation Division

Director:
J. Spankie, B.Sc., P.Eng.

Canadian Centre for Advanced Instrumentation

Electronics Group

Manager:
T. Locke, M.Sc., P.Eng.
Staff:
K. Young, B.Sc., Elec. Tech.
R. Matieshin
R. Pinchbeck

Precision Instrument Group

Manager:
O. Olm
Staff:
M. Peters
G. van Dongen

Business Development Branch

Vice President:
R. Maithel, M.Sc., P.Eng.
Assistant:
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Staff:
J. Bergsteinsson, B.A.

Industrial Engineering and Marketing Division

Staff:
D. Barnett
L. Smith, B.Comm.

Communications Department

Manager:
K. Lawrence, B.A.
Staff:
B. Erickson, B.A.
A.M. Barabas

Administration and Finance Branch

Vice President:
G. MacKay, B.A., C.R.M.
Safety Officer:
J. Meginbir, B.A.
Publications Coordinator:
E. Weegar

Analytical Services Program

Manager:
G. Smithson, Ph.D., P.Eng.
Staff:
W. Yuen, Ph.D.
M. Fahri, B.Sc.
B. Stanek, B.Sc.
S. Punani, M.Sc.
L. MacDonald
L. Ty, B.Sc.
D. Chorney, Chem. Tech.
L. Didur
G. Drader, Chem. Tech.
S. Barnes, Chem. Tech.
I. Khosla
J. Ma, B.Sc.
S. Magon
P. Moser, Chem. Tech.
V. Evans
L. Turple, B.Sc.
J. Zimmer, Chem. Tech.
L. Chrusch, B.Sc.
W. Russell, Chem. Tech.

Bovine Blood Typing Laboratory

Manager:
G.J. Kraay, Ph.D.
Staff:
S. Grams, B.Sc.
D. Wright, R.T.
L. Gerla, R.T.
U. Hollmann
J. Yanez
K. Grayson

Shops and Facilities Services

Manager:
K. Owens
Staff:
B. Marshall
D. McEwan
J. Wright
T. Voth
I. Coleman
M. Timmins
J. Hunter
B. Symak

Graphics Services

Coordinator:
J.C. Sardinha, C.C.
Staff:
B. McIntosh, C.C.
E. H. Perkins, C.E.T.
H.G. Piek
J. Mamer

Information Centre

Manager:
M. Samms, Lib. Tech.
Staff:
M.P. Will, B.Ed.
K. Sthankiya, Lib. Tech.
C. Kelly, M.A.
R. Middleton, Lib. Tech.

Departmental Services

A/Manager:
D. Collins
Staff:
D. Diduck
G. Calderon
B. Hoyseth
D. Schergevitch
B. Duerksen
B. Thomson
P. Sherwood
L. Kunstmann

Financial Services

Controller:
R.J. McGrath, M.B.A., C.M.A.
Staff:
H.A. MacEwan
L. Jones
W. Rielkoff
D. Friesen, B.A. (Adv.)
M. Dymond
K. Kosteniuk
M. Millhouse

Human Resources

Manager:
J. Sanderson
Personnel Assistant:
M. Limet